

CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME IV

Editors:

Ma'an Alkhatib
Abdullah Al Mamun
Faridah Yusof



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(VOLUME IV)

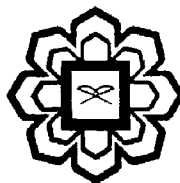
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CHAPTER 5

CARBON NANOFIBERS TO REMOVE ARSENIC

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ABSTRACT

Exposure to arsenic can cause nausea, vomiting, diarrhea, abdominal pain, fatigue, abnormal heart rhythm, abnormal bruising and skin diseases. Therefore, heavy metals must be removed from drinking water. The removal of Arsenic (As) ions from aqueous solution using carbon nanofibres (CNFs) is reported in this project. The effects of pH, CNFs dosage, contact time and initial concentration of arsenic were studied at 25° C. Adsorption study has been conducted to observe the relationships between the parameters used. This experiment demonstrated that the highest removal of Arsenic ions was 97.25%. The statistical modeling indicated that the highest removal (97.25%) of As can be attained at pH 6, initial concentration of arsenic of 0.08 mg/L, contact time of 60 min and CNF dosage of 200 mg/L. Comparison between impregnated CNF and Powdered Activated Carbon (PAC) were also done and it is determined that impregnated CNF has better removal compared to Powdered Activated Carbon (PAC) alone.

Keywords: adsorption, arsenic, CNF, heavy metal, water

INTRODUCTION

The Heavy metals are natural components of the Earth's crust and they could not be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. Some heavy metals such as copper, selenium, zinc, arsenic are poisonous at high concentration (Smith, 2000). Heavy metals are dangerous because they tend to bioaccumulate, which means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Heavy metals can enter a water supply by industrial and consumer waste, or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers, and groundwater.

Long-term exposure to arsenic via drinking-water causes cancer of the skin, lungs, urinary bladder, and kidney, as well as other skin changes such as pigmentation changes and thickening (Abernathy, 2003). Other studies indicate that arsenic may have non-cancer effects including cardiovascular disease such as high blood pressure, heart disease, and stroke, diabetes, reproductive problems and immune and nervous system problems (Smith, 2000). Therefore, an increasing awareness has been focused on the removal of arsenic from water due to its detrimental effects on human health. There are different approaches to remove arsenic from aqueous solution, including chemical precipitation, ion exchange, coagulation,